ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

WD-DWGB-3-17 2008

Sodium and Chloride in Drinking Water

The compound known as "salt" consists of the elements sodium (Na+) and chloride (Cl-). Many people use the word salt when they intend to refer to sodium. Every water supply contains some sodium and chloride. When salt dissolves in water it changes its form from a solid to an "ion." An atom or molecule that has dissolved in water is called an "ion."

Occurrence of Sodium and Chloride
Typical background levels of Na+ and Cl- for pristine locations in New Hampshire are generally less than 20 milligrams per liter (mg/L) and 30 mg/L respectively. A milligram per liter is the same as a part per million (ppm). In the immediate seacoast area, elevated levels of Na+ and Cl- occur naturally due to the proximity to sea water and salt blown contamination. Seacoast area concentrations typically range up to 75 mg/L and 150 mg/L respectively.

Normally the chloride concentration of well water exceeds the sodium by approximately 50 percent. This is caused by the relative atomic weights of each. Any judgment relative to water's salt concentration should be made only after reviewing the results of a few samples that have been taken at different times of the year.

Substantially higher levels of Na+ and Cl- tend to imply contamination by activities of man, including road salt storage, use of road salts, discharges from water softeners, human or animal waste disposal, leachate from landfills, and other activities.

DES Policy on De-icing Salts
Safe driving conditions on our highways are important to residents and visitors alike. The application of de-icing salts is a very important component of maintaining road safety. The environmental impact of de-icing salts can be minimized by use of best management practices including:

- Covering salt piles.
- Using paved areas for loading salt trucks.
- Using modern, truck-mounted, application equipment that is controllable from the operator's cab.

For more information concerning road salt management, and the effect of road salt on surface water quality, please see DES fact sheet WD-WMB-4 at www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/index.htm.

Health Implications
The following information concerning health implications has been provided by the Environmental Health Program. They can be reached at 271-4608.

At present there are no health based standards for Na+ or Cl- in EPA's Safe Drinking Water Act. In the mid-1980s, EPA had listed sodium in a group of contaminants, called the Drinking Water Priority List, for which official maximum contaminant levels (MCLs) would be developed. MCLs are health-based standards that must be

met by public water systems (PWS). A subsequent review of scientific evidence by EPA showed that the vast amount of sodium ingestion was from food rather than drinking water, and that the linkage between sodium and hypertension (high blood pressure) was still not well documented. Consequently in 1988, EPA removed sodium from that list of drinking water contaminants proposed to be formally regulated by the Safe Drinking Water Act.

In March 1998, EPA reissued this list which is now known as the Drinking Water Contaminant Candidate List (DWCCL). That list included sodium. The third edition of the DWCCL is being prepared and will likely be available in 2009. Sodium is not on that list.

Brief EPA discussions concerning sodium in drinking water have appeared in the following editions of the *Federal Register:*

- Wednesday, November 13, 1985, page 46980
- Wednesday, July 8, 1987, page 25723
- Friday, January 22, 1988, page 1894
- Monday, January 14, 1991, page 1471
- Monday, October 6, 1997, page 52211
- Monday, March 2, 1998, page 10283

When considering the health importance of Na+ and Cl-, EPA assumed that water users consume two liters of water per day, and that 10 percent or less of a person's daily sodium intake comes from drinking water. The rest is usually from food. Persons on a sodium restricted diet should evaluate all possible sources of sodium when attempting to reduce overall sodium intake. It is often much easier, and less expensive, to make a dietary change than to excessively purify drinking water.

EPA has recommended that sodium levels not exceed 20 mg/L for those persons on a **physician-prescribed** "no salt diet." This is the same level recommended by the American Heart Association. This is a very stringent level. For comparison purposes, regular milk has a sodium concentration of approximately 500 mg/L. The sodium levels of certain other major foods are listed below.

Food Product	**Sodium Concentration (mg/L)**
Antacid	500
Tomato sauce, 1 cup	1,500
Ham, 3 oz.	1,100
Bacon, 4 slices	550
Cottage cheese	450
White wine, 4 oz.	20
Club soda, 8 oz.	40

Na+ and Cl- are generally not major contaminants in the water served by community public water systems in New Hampshire. Such systems typically have concentrations of Na+ and Cl- that are less than 75 mg/L each in almost all cases. Your local public water system is required to inform its customers annually of all water quality factors, including Na+ and Cl-. There are no known health concerns with chloride.

Secondary (Aesthetic) Drinking Water Standards

Both Na+ and Cl- cause a taste in water. EPA has identified a concentration of over 250 mg/L of either Na+ or Cl- as a concentration which can be expected to impart a salty taste to drinking water. Water users typically note the presence of high chloride before an equal amount of sodium. The secondary level of 250 mg/L is based on aesthetic concerns, and is only advisory in the EPA Safe Drinking Water Act program.

Control of Sodium and Chloride
Normally, the best method to control Na+ and Cl- in drinking water is to better manage those activities that add salt near the recharge area of the water supply source(s). The following are the most common sources of salt in water supply recharge areas.

Application of road de-icing salts. Road salt runoff can contaminate groundwater. Limiting the application of salt in the vicinity of a well, rerouting runoff, and installing clay-lined drainage swales along the roadside may all reduce the Na+ and Cl- concentrations in adjacent wells. If a well is contaminated by de-icing salts, and the origin is suspected to be from a **state** highway, the New Hampshire Department of Transportation, Bureau of Highway Maintenance, may help to correct the situation. The Bureau of Highway Maintenance can be reached at 271-2693.

Water softeners add sodium to drinking water in two ways. Sodium is exchanged for hardness directly during the softening process, and indirectly by the discharge of waste brine (salt dissolved in water) into subsurface disposal systems. The amount of salt added by a water softener is most influenced by the water's hardness. High hardness increases the sodium level of the treated water

The volume of waste brine generated by the regeneration cycle of a softener can be reduced by using a water meter or ion probe to trigger regeneration cycle. This method is called demand regeneration. See DES fact sheet WD-WSEB-2-12, "Ion Exchange Treatment of Drinking Water" at www.des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm.

Other Sources. Many water treatment chemicals have sodium as a basic ingredient. These chemicals often perform a valued treatment function. However, they do raise the sodium level in water proportional to the amount applied. Near the coast, some sodium and chloride may be due to sea water from either storm spray or underground intrusion.

Sanitary Significance of Sodium and Chloride
Na+ and Cl- are also present in human wastewater. Finding the source of elevated Na+ and Cl- is important since Na+ and Cl- may indicate the nearby disposal of human wastewater or solid fecal waste. The presence of elevated Na+ and Cl- must initially be considered as an indication of increased risk of more serious bacterial or chemical pollution until a more detailed analysis identifies the origin of the Na+/ Cl-..

Treatment to Remove Sodium or Chloride
Sodium and chloride are costly to remove from water. Effective treatment types include:

Reverse Osmosis (RO)
This method places contaminated water against a special membrane. The membrane allows water molecules to move through, but retards salt and other dissolved minerals. RO is not practical for high volume needs due to the inefficiency associated with the cold water "reject" rate. See DES fact sheet WD-WSEB- 2-11 for more information on RO at www.des.nh.gov/organization/commissioner/-pip/factsheets/dwgb/index.htm

Distillation
This method first boils water to produce steam. The steam is then condensed to produce purified drinking water. Salts and other mineral impurities stay in the boiling chamber. The boiling chamber requires periodic cleaning to remove the accumulated minerals. Distillation is not effective for organic contaminants. Distillation is only feasible for a few gallons of water produced per day. Distillation is costly to operate. The reject heat during the summer is objectionable to most people. See fact sheet WD-WSEB-2-15 (at the same website as above) for more information on distillation.

De-ionization
This method has similarities to a water softener, but uses strong acids and bases rather than salt to regenerate the system. While it is an effective method, the dangerous chemicals are inappropriate in a residential home. See fact sheet WD-WSEB-2-12 (at the same website as above) for more information on deionization treatment.

Where treatment is going to be installed, the size of the device can range from an under-the-sink sized system to a full house sized system. If only pure **drinking** water is the goal, then an under-the-sink system will suffice.

The presence of elevated levels of sodium and chloride somewhat increases the water's ionic conductance, and thus slightly increases the potential for corrosive water damage to plumbing fixtures. To reduce this damage, a whole house water treatment system would need to be installed. Bottled water is also an option to address the health concerns posed by leached lead and copper caused by corrosive water, while a long-term treatment solution is being investigated.

For further information concerning the layout of a water treatment system and its purchase, see WD-WSEB-2-5 Considerations when Purchasing a Water Treatment System at www.des.nh.gov/organization/commissioner/-pip/factsheets/dwgb/index.htm .

Vegetation Damage
Highway de-icing salt application can impact vegetation. Windblown salt spray can be as much a concern as salt-laden water runoff. In general, the damage to the environment lessens with greater distance from the road, lower salt application rates, and the species of vegetation and trees. Salt-tolerant tree species include Norway maples, horse chestnut, white ash, Colorado spruce, white poplar, and golden weeping willow. For more details concerning vegetation damage please call the UNH Cooperative Extension at (603) 862-3200.

FOR MORE INFORMATION
Please contact the Drinking Water and Groundwater Bureau and the New Hampshire Water Well Board at (603) 271-2513 or dwgbinfo@des.state.nh.us or visit our website at www.des.nh.gov/organization/divisions/water/-dwgb/index.htm. All of the bureau's fact sheets are on-line at www.des.nh.gov/organization/commissioner/pip/-factsheets/dwgb/index.htm.

Note: This fact sheet is accurate as of August 2008. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.